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STALLING of TAPERED WINGS

A Reply to Dr. Lachmann's Recent Article in "Flight"

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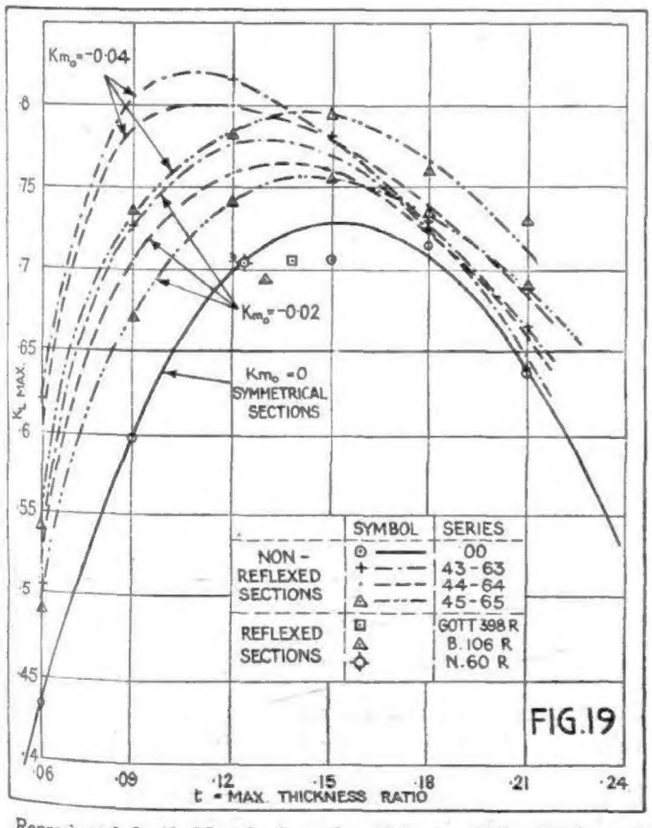
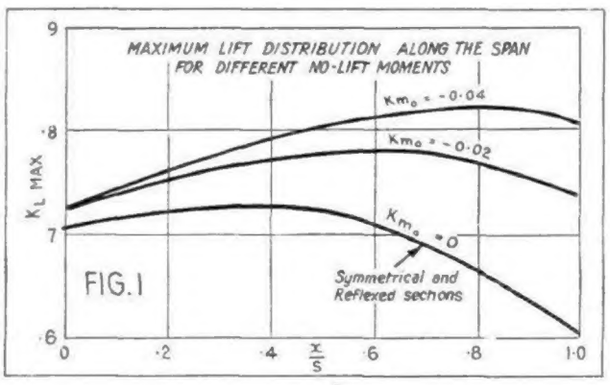
IN an article which appeared in *Flight* of January 2 under the above title, Dr. G. V. Lachmann gave theoretical reasons to show why a tapered wing stalls first at the tip instead of at the root as in the case of a parallel wing.

Except that the wings he considers are tapered in plan form and are without aerodynamic twist, no limitation is given as to the aerofoil section along the span. From a study of his conclusions, it is obvious that he has considered only wings having the same aerofoil section along the span, that is to say, the relationship between thickness and chord is the same at any section. This undefined limitation is the reason for the conclusions at which he has arrived, as will be demonstrated later. This limitation is hardly in accord with almost universal practice so far as cantilever wings are concerned. It may be true for certain biplane arrangements or nearly so for wings with elliptical plan forms, where the thickness ratio is more or less constant along the span.



Reproduced from Mr. Andrews' article on "The Design of Aerofoils and the Prediction of Characteristics," *The Aircraft Engineer*, December 28, 1933.



In practice, the more general method of designing wings is to adopt a straight taper, at any rate for the outer portions, and to employ a thickness—chord ratio of about 18 to 20 per cent. at the root, tapering to 9 or 10 per cent. at the tip. The amount of taper in plan (expressed as tip chord ÷ root chord) seems to be from $\lambda = 0.45$ to $\lambda = 0.6$ and for the purposes of illustration tapers of 0.75 and 0.5 have been assumed combined with $t = .18$ at the root tapering linearly to .09 at the tip. These arbitrary cases have been chosen because the loading curves are given in A.P.970 and by coincidence the case of $\lambda = 0.5$ roughly represents current practice for cantilever monoplanes.

It has been demonstrated in a previous article ("The Design of Aerofoils and the Prediction of Characteristics" —*The Aircraft Engineer*, November 30 and December 28, 1933) that the maximum lift of a wing varies with (*a*) **The**